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(54) Title: **PRODUCTION OF GLOVES AND OTHER ARTICLES OF FLEXIBLE POLYMER MATERIAL**

(57) Abstract: A process for producing an article in a flexible foamed polymer material, including treating a former with a coagulant; dipping the treated former in a latex foam mixture to form a layer of the mixture on the former that includes air cells; curing the layer to gel the foam mixture to a cross-linked open cell structure; and stripping the layer from the former; where the latex foam mixture includes a natural latex polymer as a primary polymer component, and a synthetic latex polymer as a secondary polymer component, which synthetic latex polymer is selected to enhance the evenness and/or fineness of said open cell structure.

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## PRODUCTION OF GLOVES AND OTHER ARTICLES OF FLEXIBLE POLYMER MATERIAL

### Field of the Invention

This invention relates generally to the manufacture of articles in a flexible  
5 foamed polymer material. The invention is particularly useful in the production of  
articles such as gloves in foamlined natural or synthetic latex, and in one aspect  
further relates to a novel latex foam glove.

### Background Art

A known process for producing foamlined latex or rubber gloves involves  
10 the dipping of a former, pre-treated with a suitable coagulant, in a latex foam  
mixture to form a layer of the mixture on the former. The layer includes closed air  
cells and is subjected to a curing operation to gel the foam mixture to a cross-  
linked open cell structure. This primary article is stripped from the former and  
subjected to various post-treatments including washing and drying.

15 A variety of latex compositions including natural and synthetic rubbers are  
disclosed in U.S. patents 3,968,285, 4,373,033, 5,332,621 and 5,084,514. U.S.  
4,373,033 discloses a blend of high styrene resin, natural rubber and latex. U.S.  
5,332,621 discloses a latex comprising 20-100% by weight of SBR latex, with a  
minimum proportion of more than 15% by weight of styrene, and 80-0% by weight of  
20 natural rubber latex or other synthetic latexes. U.S. 5,084,514 relates to the  
manufacture of gloves. For the purpose of obtaining what the reference describes as  
excellent donning and doffing characteristics, the latex includes a carboxylated latex  
terpolymer of butadiene/acrylonitrile methacrylate, and preferably another component  
selected from a wide range of synthetic and natural rubbers.

25 It is a general objective of the present invention to modify one or more  
aspects of this known process in order to achieve improvements in the process  
itself and/or in the end product.

## Summary of the Invention

In a first aspect of the invention, it has been discovered that if the latex polymer components of the latex foam mixture include a natural latex polymer as a primary component and a synthetic latex such as an acrylic terpolymer or polyurethane polymer as a secondary component, significant benefits can be obtained in the open cell structure of the final latex foam layer.

In accordance with the first aspect of the invention, therefore, there is provided a process for producing an article in a flexible foamed polymer material, including:

- 10           treating a former with a coagulant;
- dipping the treated former in a latex foam mixture to form a layer of the mixture on the former that includes air cells;
- curing the layer to gel the foam mixture to a cross-linked open cell structure; and
- 15           stripping the layer from the former;

where the latex foam mixture includes a natural latex polymer as a primary polymer component, and a synthetic latex polymer as a secondary polymer component, which synthetic latex polymer is selected to enhance the evenness and/or fineness of said open cell structure.

- 20           With optimum choice of the synthetic latex polymer, a very even open cell structure can be achieved that offers good insulation against both heat and cold and excellent sweat absorption. Advantageously, it is possible to achieve a air content in the cured layer in the range 30-60%, more preferably in the range 45-55%. In this way, a higher than conventional air content can be achieved with
- 25           optimal performance, thereby reducing the material cost of providing protection by way of the cured layer.

The synthetic polymer used is preferably a proprietary acrylic copolymer, a polyurethane polymer or a blend of both. The acrylic copolymer is advantageously

an acrylic terpolymer.

Preferably, the synthetic polymer is present in a proportion of the total of the primary and secondary polymer components in the range 2-10%, more preferably about 5-6%.

5        A second aspect of the invention concerns the surfactant package employed in the latex foam mixture. Typically, the latex foam mixture includes one or more latex polymers, for example the mix of primary and secondary polymer components of the first aspect of the invention, air bubbles injected into the mixture, and selected dispersion components. Such dispersion components may  
10 typically include a cure package such as zinc oxide/sulphur/selected dithiocarbonates or thiurams etc. for cross-linking, antioxidants for reduction of ageing, pigments and viscosity modifiers. A typical latex foam mixture further includes surfactant packages that, among other roles, are useful in stabilising and sustaining the combination of latex polymer(s), air bubbles and dispersion  
15 components. It has been found, in accordance with a second aspect of the invention, that a particularly effective surfactant package for this purpose includes a pair of foam stabiliser sub-packages including a salt of a fatty acid soap and a protonated amine oxide.

Accordingly, the invention provides, in a second aspect, a process for  
20 producing an article in a flexible foamed polymer material, including:

treating a former with a coagulant;

dipping the treated former in a latex foam mixture to form a layer of the mixture on the former that includes air cells;

25 curing the layer to gel the foam mixture to a cross-linked open cell structure; and

stripping the cured layer from the former;

wherein the latex foam mixture includes in combination one or more latex polymers, air bubbles and dispersion components, and further includes a surfactant package having a salt of a fatty acid soap and a protonated amine

oxide for stabilising and sustaining said combination.

Preferably, the salt of a fatty acid soap is associated with a fatty alcohol, and the protonated amine oxide is associated with an anionic surfactant.

It is thought that interaction occurs between the protonated amine oxide  
5 cation and the anion of the salt, where the cation and anion are very strongly hydrogen bonded via the  $H^+$  of the cation. The same occurs for the fatty acid alcohol containing OH groups to form hydrogen bonding with the anionic surfactant. Hence the nature of the polar group is significant in facilitating the formation of hydrogen bonding to increase the foam stability.

10 The surfactant package is found to be useful in optimising air dispersion in the latex foam mixture.

Preferably, in the latex foam mixture, and relative to a latex polymer content of 100 parts, the primary surfactant, e.g. a salt of a fatty acid soap, is present in the range of 1-2 parts, most preferably about 1.5 parts, and the secondary  
15 surfactant, the protonated amine oxide, is present in the range 0.5 to 1.5 parts, preferably about 1 part.

The fatty alcohol and anionic surfactant are each preferably present in the range 0.5 to 1.5 parts, most preferably about 1 part.

By way of example, the salt may be the sulphated alkali metal salt of a long  
20 chain fatty acid such as lauryl acid or oleic acid, eg. sodium or potassium lauryl sulphate. A suitable protonated amine oxide is lauryl dimethylamine oxide. The fatty alcohol may usefully then be lauryl myristyl alcohol, and the anionic surfactant may conveniently be sodium dodecylbenzene sulphonate.

The latex foam mixture will typically include one or more cross-linking  
25 activators, accelerators and/or agents to facilitate the gelation process. For maintaining the dispersion of these components, the surfactant package preferably further includes appropriate anionic stabilisers.

A third aspect of the invention relates to the dipping step and its effect on the subsequent curing process. In the aforementioned known process, the former is typically treated with a coagulant by first dipping the former into a tank containing the coagulant, most commonly an aqueous solution of calcium nitrate, and allowing it to dry on the former just prior to a first latex dip. Following this dip, the former, with a first layer of the latex mixture thereon, is leached in water tanks to extract excess calcium nitrate, leaving just enough present to coagulate the second latex layer in a following second latex dip.

In accordance with a third aspect of the invention, it has been found advantageous to treat the former with the first latex layer already thereon with a strong coagulant solution immediately prior to the second dip.

It has also been found advantageous to incorporate into the foam latex a thixotropic agent which functions to allow easy flow during stirring and dipping but which increases the viscosity of the latex rapidly as soon as shearing (stirring in the tank and dipping) ceases, thereby allowing the foam latex to remain as a thick, even layer on the former until the former passes into the oven.

Accordingly, in the third aspect of the invention, there is provided a process for producing an article in a flexible foamed polymer material, including:

- treating a former with a coagulant;
  - dipping the treated former in a latex foam mixture to form the layer of the mixture on the former that includes air cells;
  - curing the layer to gel the foam mixture to a cross-linked open cell structure; and
  - stripping the cured layer from the former;
- wherein said dipping is effected by dipping the treated former twice so as to form successive layers of an unfoamed latex and said latex foam mixture thereon, and wherein, after the first dip, the former with said unfoamed latex layer thereon is leached to remove excess coagulant and then treated with a relatively stronger coagulant to accelerate said gelation and to enhance bonding between said

layers.

It is thought that the first layer should be unfoamed for greater tensile strength and durability.

Said coagulant is conveniently calcium nitrate, and said leaching is preferably in water. The coagulant employed for the second treatment is preferably stronger by virtue of being more concentrated. The latex foam mixture is preferably rendered thixotropic by utilising as a thixotropic agent a proprietary modified bentonite.

If necessary, said cured layer is leached, preferably in water, to extract excess coagulant.

A fourth aspect of the invention concerns the control of the curing step. Essentially, the primary facet of the curing is a cross-linking reaction that converts the latex into a truly elastic film. During this process, several other changes must take place in correct sequence. As the cross-linking proceeds, the viscosity of the polymer increases rapidly and water evaporates. The walls of the air cells must rupture so that the open cell structure is formed, a desirable feature for sweat absorption and flexibility. However, it is preferred that the cell walls do not rupture too early or polymer viscosity will be still too low and the foam will collapse. In accordance with the fourth aspect of the invention, it is preferred that some of the air cells at the surface do collapse so that a thin film, preferably a very thin film of substantially solid latex, apart from perforations where the air bubbles were located, is formed. This film provides a suitable substantially continuous surface which may subsequently be treated, e.g. by chlorination and optionally leaching to reduce its permeability and/or friction and/or allergenicity.

More particularly, in the fourth aspect of the invention, there is provided a process for producing an article in a flexible foamed polymer material, including:

treating a former with a coagulant;

dipping the treated former in a latex foam mixture to form a layer of

the mixture on the former that includes air cells;

curing the layer to gel the foam mixture to a cross-linked open cell structure; and

stripping the cured layer from the former;

- 5            wherein said curing is controlled whereby said cured layer with an open cell structure includes one or more surface films of substantially solid perforated latex.

Preferably, said film(s) is treated to reduce its permeability and/or friction and/or allergenicity.

- Preferably, the fourth aspect further includes controlling the dipping step to  
10 further facilitate the recited outcome.

Advantageous control factors include the dip speed, and the air drying and heating profile, of ovens employed in the curing step.

- The said treatment of the film is advantageously by chlorination, e.g. by  
subjecting the cured and cooled layer while still on its former to an aqueous  
15 solution containing dissolved chlorine or a dissolved source of chlorine. Chlorine reacts with the latex film to form a surface of low permeability and low friction, and also denatures proteins by reacting with them and reducing their allergenicity. The treatment preferably further includes multiple subsequent leaching steps, eg. with water at temperatures varying from 90-40°C.

- 20            In this way, where the article is a glove or other item of apparel, it is possible to produce a chlorinated film surface which is adapted to easy donning (i.e. putting the gloves on and off).

- Accordingly, in the fourth aspect of the invention, there is also provided a latex foam glove in which the interior contact surface of the glove is provided by a  
25 surface film of substantially solid perforated latex on an underlying layer of a cross-linked open cell structure, which surface film is unlined but treated to enhance its donnability and whereby the extractable protein level of the glove as



measured by EN test method 455-33 is below 50 micrograms per gram of rubber preferably below 30 micrograms per gram of rubber. The extractable protein level is a recognised measure of allergenicity.

Preferably, in all of the above-described aspects of the invention, the latex  
5 foam mixture includes a thixotropic agent selected to maintain the aforesaid air  
bubbles in stable suspension so that they "freeze" in place on the former  
immediately on withdrawal of the former from said dip in the latex foam mixture.  
This stabilises the foam after dipping and reduces dripping and/or runback of the  
foam before it can be cross-linked. A suitable thixotropic agent is bentonite or  
10 other modified silicate composition.

In a fifth aspect of the invention, there is provided a process for producing  
an article in a flexible foamed polymer material, including:

treating a former with a coagulant;  
dipping the treated former in a latex foam mixture to form a layer of  
15 the mixture on the former that includes air cells;  
curing the layer to gel the foam mixture to a cross-linked open cell  
structure; and  
stripping the layer from the former;

wherein the latex foam mixture includes a thixotropic agent selected to  
20 maintain air bubbles in stable suspension so that they freeze in place on the  
former immediately on withdrawal of the former from said dip in the latex foam  
mixture.

Advantageously, in all aspects of the invention, after said dipping step and  
before the curing step, the former is turned over to allow the layer of latex foam  
25 mixture to smooth out and run over the surface of the former to enhance  
evenness of the coating.

Preferably, in all aspects of the invention, one or more curing and/or cross-  
linking agent(s) included in the latex foam mixture is or are selected to provide a

relatively low sulphur containing cure package which enhances the proportion of mono-sulphidic cross-links, producing enhanced resistance to compression set and better recovery properties.

Preferably, in all aspects of the invention, for providing the air bubbles in  
5 the latex foam mixture, air is compressed and mixed with the aforementioned latex polymer or mixture of latex polymers, and then pumped into a mixing head which is rotating at high speed and thereby creating high shearing forces in order to ensure good mixing and creation of an even foam. The bubble size is adjustable by changing the shearing speed of the mixing head. The content of air can be  
10 varied in the range 0-70% by adjusting air pressure and flow. The proportion of air in the foam, i.e. the foam density, is advantageously controlled in order to control the viscosity of the foam during handling and dipping, and the thickness and final density of the cured layer of the article produced.

The invention extends to any combination in a common process of one or  
15 more of the five aspects of the invention.

### **Preferred Embodiment and Example**

The invention will now be further described, by reference to an exemplary process, incorporating embodiments of all five aspects of the invention, for producing latex foam gloves.

20 A continuous sequence of glove formers, which may be left handed or right handed or ambidextrous, was first subjected to pre-cleaning in an acid bath. The cleaned formers were dipped in a first aqueous solution of a coagulant e.g. calcium nitrate at 250-300 g/l which was allowed to dry before the treated former was dipped into and withdrawn from a first tank of a prepared non-foaming latex  
25 mixture.

The resultant first latex layer, which was unfoamed latex rubber, formed the outside layer in the subsequent glove. The layer was leached in water tanks to extract excess calcium nitrate. In accordance with an embodiment of the third

aspect of the invention, the layered former was now dipped into a strong aqueous solution of coagulant, typically again calcium nitrate but at 300-400 g/l. Both coagulant dips were at a temperature in the range 60-75°C. The coagulant was allowed to dry and the former, with its first unfoamed outer layer, was dipped into  
5 a tank of the latex foam mixture containing a bentonite - modified silicate as a thixotropic agent.

A suitable latex foam mixture is set out in Table 1.

The latex foam mixture was maintained at a temperature in the region of 18-20°C by using high displacement impellers to circulate the latex along the  
10 bottom of the tank past heat exchangers made from stainless steel dimple plate. The latex then rises past a battery of high speed whipping stirrers which assist in maintaining foam quality, and then across the surface of the latex in the tank at a speed similar to the speed of travel of the formers as they were passed through the tank.

15 After removal from this tank, with a second latex layer comprising the latex foam mixture that would be the liner of the subsequent glove, the former was turned over to facilitate an enhanced even coating of the second layer on the former, and then passed to the curing ovens. Here, the liner layer was cured to gel the layer to a cross-linked open cell structure. As the cross-linking proceeds, the  
20 viscosity of the polymer increases rapidly and water evaporates. The walls of the air cells must rupture so that the open cell structure is formed, a desirable feature for sweat absorption and flexibility. The dipping and curing were controlled so that the cured layer included a surface film of substantially solid latex, apart from perforations where the bubbles were located. In general, this control is achieved  
25 by setting appropriate dip line speeds according to the machine used but typically in the range of 4-14 ft/min, and oven temperatures in the range 95-155°C. These are adjusted to optimise the foam parameters.

After cooling by dipping in a water tank, the article, still on the former, was leached to remove excess calcium nitrate and then passed through water  
30 containing dissolved chlorine to 2000 ppm. The chlorine reacts with the

aforementioned latex surface film to create a surface layer which has a lower permeability and a low friction, resulting in enhanced donnability. The chlorine also denatures proteins by reacting with them and reducing their allergenicity.

5       Following the chlorination treatment, the article was leached in water at temperatures in the range 90-40°C several times, rinsed and then stripped from the former during which it was reversed to bring the first layer to the outside and to have the foamed layer as an inner liner, with the surface at the interior.

There were then the usual further post treatments, including washing and drying.

10       The glove thus formed had excellent donning qualities and was found to have an extractable protein level as measured by EN test method 455-3 below 50 micrograms per gram of rubber. Typical extractable protein levels measured have been in the range 20 to 30 µg/gm of rubber.

Type of Component	Component employed	Composition Range (percent by weight)
Natural latex polymer	natural rubber (polyisoprene)	90-98
Synthetic latex polymer	acrylic terpolymer	10-2
Surfactant package:		
Salt of fatty acid soap	sodium lauryl sulphate	1-2
Profonated Amine oxide	lauryl dimethylamine oxide	0.5-1.5
Fatty Alcohol	lauryl myristyl alcohol	0.5-1.5
Anionic surfactant	sodium dodecylbenzene sulphonate	0.5-1.5
Anionic stabilisers	modified alkyl aryl sulphonate and sodium naphthelene sulphonate	0.02-0.5
Thixotropic agent	bentonite-modified silicate	1-3
plus		
Conventional cross-linking agents and accelerators, foam promoters. Antioxidants, pigments and viscosity modifiers		

Table 1 - Composition of Latex Foam Mixture

**CLAIMS**

- 1 A process for producing an article in a flexible foamed polymer material, including:
- 5 treating a former with a coagulant;
- dipping the treated former in a latex foam mixture to form a layer of the mixture on the former that includes air cells;
- curing the layer to gel the foam mixture to a cross-linked open cell structure; and
- stripping the layer from the former;
- 10 where the latex foam mixture includes a natural latex polymer as a primary polymer component, and a synthetic latex polymer as a secondary polymer component, which synthetic latex polymer is selected to enhance the evenness and/or fineness of said open cell structure.
- 2 A process according to claim 1 wherein said synthetic latex polymer is a  
15 proprietary acrylic copolymer, a polyurethane polymer or a blend of both.
- 3 A process according to claim 1 or 2 wherein said synthetic latex polymer is an acrylic terpolymer.
- 4 A process according to claim 1, 2 or 3 wherein said synthetic latex polymer  
20 is present in a proportion of the total of the primary and secondary polymer components in the range 2-10%.
- 5 A process according to claim 4 wherein said synthetic latex polymer is present in a proportion of the total of the primary and secondary polymer components in the range 5-6%.
- 6 A process according to any one of claims 1 to 5 wherein the air content in  
25 the cured layer is in the range 30-60%, preferably in the range 45-55%.

- 7 A process according to any one of claims 1 to 6 wherein the latex foam mixture includes in combination one or more latex polymers, air bubbles and dispersion components, and further includes a surfactant package having a salt of a fatty acid soap and a protonated amine oxide for stabilising and sustaining said combination.
- 5
- 8 A process according to any one of claims 1 to 7 wherein said dipping is effected by dipping the treated former twice so as to form successive layers of an unfoamed latex and said latex foam mixture thereon, and wherein, after the first dip, the former with said unfoamed latex layer thereon is leached to remove excess coagulant and then treated with a relatively stronger coagulant to accelerate said gelation and to enhance bonding between said layers.
- 10
- 9 A process according to any one of claims 1 to 8 wherein said curing is controlled whereby said cured layer with an open cell structure includes one or more surface films of substantially solid perforated latex, wherein said film(s) is treated to reduce its permeability and/or friction and/or allergenicity.
- 15
- 10 A process for producing an article in a flexible foamed polymer material, including:
- 20
- treating a former with a coagulant;
  - dipping the treated former in a latex foam mixture to form a layer of the mixture on the former that includes air cells;
  - curing the layer to gel the foam mixture to a cross-linked open cell structure; and
- 25
- stripping the cured layer from the former;
- wherein the latex foam mixture includes in combination one or more latex polymers, air bubbles and dispersion components, and further includes a surfactant package having a salt of a fatty acid soap and a protonated amine oxide for stabilising and sustaining said combination.

- 11 A process according to claim 10 wherein the salt of a fatty acid soap is associated with a fatty alcohol, and the protonated amine oxide is associated with an anionic surfactant.
- 12 A process according to claim 10 or 11 wherein, in the latex foam mixture, and relative to a latex polymer content of 100 parts, the primary surfactant, eg. a salt of a fatty acid soap, is present in the range of 1-2 parts.
- 13 A process according to claim 12, wherein, on the same basis, the secondary surfactant, the protonated amine oxide, is present in the range 0.5 to 1.5 parts.
- 14 A process according to any one of claims 10 to 13 wherein said salt is the sulphated alkali metal salt of a long chain fatty acid.
- 15 A process according to any one of claims 10 to 14 wherein said dipping is effected by dipping the treated former twice so as to form successive layers of an unfoamed latex and said latex foam mixture thereon, and wherein, after the first dip, the former with said unfoamed latex layer thereon is leached to remove excess coagulant and then treated with a relatively stronger coagulant to accelerate said gelation and to enhance bonding between said layers.
- 16 A process according to any one of claims 10 to 15 wherein said curing is controlled whereby said cured layer with an open cell structure includes one or more surface films of substantially solid perforated latex, wherein said film(s) is treated to reduce its permeability and/or friction and/or allergenicity.
- 17 A process for producing an article in a flexible foamed polymer material, including:

treating a former with a coagulant;

dipping the treated former in a latex foam mixture to form the layer of



the mixture on the former that includes air cells;

curing the layer to gel the foam mixture to a cross-linked open cell structure; and

stripping the cured layer from the former;

5        wherein, said dipping is effected by dipping the treated former twice so as to form successive layers of an unfoamed latex and said latex foam mixture thereon, and wherein, after the first dip, the former with said unfoamed latex layer thereon is leached to remove excess coagulant and then treated with a relatively stronger coagulant to accelerate said gelation and to  
10        enhance bonding between said layers.

18        A process according to claim 17 wherein said leaching is in water.

19        A process according to claim 17 or 18 wherein the latex foam mixture is rendered thixotropic by utilising as a thixotropic agent a proprietary modified bentonite.

15    20        A process according to claim 17, 18 or 19 wherein said cured layer is leached, preferably in water, to extract excess coagulant.

21        A process according to any one of claims 17 to 20 wherein said curing is controlled whereby said cured layer with an open cell structure includes one or more surface films of substantially solid perforated latex, wherein said  
20        film(s) is treated to reduce its permeability and/or friction and/or allergenicity.

22        A process for producing an article in a flexible foamed polymer material, including:

treating a former with a coagulant;

25        dipping the treated former in a latex foam mixture to form a layer of the mixture on the former that includes air cells;

curing the layer to gel the foam mixture to a cross-linked open cell

structure; and

stripping the cured layer from the former;

wherein said curing is controlled whereby said cured layer with an open cell structure includes one or more surface films of substantially solid perforated latex.

5

23 A process according to claim 22 wherein said film(s) is treated to reduce its permeability and/or friction and/or allergenicity.

24 A process according to claim 23 wherein said treatment of the film is by chlorination.

10 25 A process according to claim 22, 23 or 24 further including controlling the dipping step to further facilitate the recited outcome.

26 A process according to any preceding claim, wherein the latex foam mixture includes a thixotropic agent selected to maintain air bubbles in stable suspension so that they freeze in place on the former immediately on withdrawal of the former from said dip in the latex foam mixture.

15

27 A process for producing an article in a flexible foamed polymer material, including:

treating a former with a coagulant;

dipping the treated former in a latex foam mixture to form a layer of the mixture on the former that includes air cells;

20

curing the layer to gel the foam mixture to a cross-linked open cell structure; and

stripping the layer from the former;

25

wherein the latex foam mixture includes a thixotropic agent selected to maintain air bubbles in stable suspension so that they freeze in place on the former immediately on withdrawal of the former from said dip in the

latex foam mixture.

- 28 A process according to any preceding claim, wherein after said dipping step  
and before the curing step, the former is turned over to allow the layer of  
latex foam mixture to smooth out and run over the surface of the former to  
5 enhance evenness of the coating.
- 29 A process according to any preceding claim, wherein one or more curing  
and/or cross-linking agent(s) included in the latex foam mixture is or are  
selected to provide a relatively low sulphur containing cure package which  
enhances the proportion of mono-sulphidic cross-links, producing enhanced  
10 resistance to compression set and better recovery properties.
- 30 A process according to any preceding claim, wherein, for providing air  
bubbles in the latex foam mixture, air is compressed and mixed with the  
aforementioned latex polymer or mixture of latex polymers, and then  
pumped into a mixing head which is rotating at high speed and thereby  
15 creating high shearing forces in order to ensure good mixing and creation of  
an even foam.
- 31 A process according to any preceding claim wherein said article is a foam-  
lined latex glove.
- 32 A foam latex glove when produced by the process of any one of claim 1 to  
20 31.
- 33 A latex foam glove when produced by the process of claim 23 or 24,  
wherein said surface film is unlined but treated to enhance its donnability  
and whereby the extractable protein level of the glove as measured by EN  
test method 455-3 is below 50 micrograms per gram of rubber.
- 25 34 A latex foam glove in which the interior contact surface of the glove is  
provided by a surface film of substantially solid perforated latex on an  
underlying layer of a cross-linked open cell structure, which surface film is

unlined but treated to enhance its donnability and whereby the extractable protein level of the glove as measured by EN test method 455-3 is below 50 micrograms per gram of rubber.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU01/00125

**A. CLASSIFICATION OF SUBJECT MATTER**Int. Cl. <sup>7</sup>: B29C 41/14, A41D 19/00 // B29L 31:48

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

-

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

-

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPAT: keywords: latex, glove, dip, coat, foam, cell

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Derwent Abstract Accession No. 91-248731/34 class P21 & Patent Abstracts of Japan JP 03-161501 A (TSUKIHOSHI KASEI KK) 11 July 1991 Abstract	1, 8-9, 15-25, 29, 31
A	US 3968285 A (COFFIN et al.) 6 July 1976 Abstract	
A	US 3945049 A (BARLOW) 23 March 1976 Abstract	

☐ Further documents are listed in the continuation of Box C
 ☒ See patent family annex

* Special categories of cited documents:	
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"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

6 April 2001

Date of mailing of the international search report

18 April 2001

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International application No.  
**PCT/AU01/00125**

Patent Document Cited in Search Report			Patent Family Member				
JP	3161501	NONE					
US	3968285	CA	984535	NL	7203370	US	3969289
		CA	1015899				
US	3945049	NONE					
END OF ANNEX							